California Grey Bears

Food Scrap Diversion Project

FINAL REPORT

Contract # IWM-C9061A
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County of Santa Cruz Interest in Diversion of Commercial Organics

Food discards make up 10 percent by weight of the total municipal waste stream and can be a higher portion of commercial sector wastes. A 1999 Santa Cruz County Waste Characterization study showed that food waste makes up a high percentage of the franchise-collected waste for food-related businesses in the County. For restaurants, food is 47.7% of the waste stream. For retail food stores, food is 32.7% of the waste stream.

Starting in 1997, the County contracted with Organic Recyclers Anonymous to work with food-related businesses to divert food scraps from disposal to beneficial use. A database of food-scrap generating businesses has been developed, and businesses have been given assistance with diversion, through on site use of worm bins, and matching with composters and animal feeders.

In 2000, the County, applied to the California Integrated Waste Management Board for contractual funds to set up an on-site diversion system using Earth Tubs. Earth Tubs are a mid-scale composting option, appropriate for grocery stores, restaurants and institutions generating 50 or more pounds of food scraps per day. The system provided a demonstration to encourage food-related businesses to divert food scraps to beneficial use. The goal of the project was to explore the viability of the in-vessel system for use at food scrap-generating businesses and to educate business owners and the community about the importance of and options for food scrap diversion.
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Project Partners and Roles

California Grey Bears is a non-profit that distributes surplus food to seniors and the disabled through a Brown Bag Program. Each week, approximately one ton of the food that is collected is discarded, primarily due to deterioration. The in-vessel system was used to compost discards from the Brown Bag Program as well as food scraps and biodegradable table service from Grey Bears annual Holiday Dinner. Grey Bears provided food discards, labor and equipment for set up and installation of the in-vessel units, on-going electrical costs, and labor for daily operations. They also distributed finished compost.

The County of Santa Cruz was responsible for overall project management and task coordination. County staff assisted with set up and installation of the units and troubleshooting support. In cooperation with ORA, County staff coordinated project outreach. The County provided funds for technical support of the project.

Organic Recyclers Anonymous (ORA) is a private consulting firm specializing in organic waste diversion. ORA provided technical support for the project, including project management, coordination of set up and installation of the in-vessel units, operational support and troubleshooting, and project outreach.

The California Integrated Waste Management Board (CIWMB) provided funds for acquisition of the in-vessel units and installation of electrical and plumbing systems.

System Description

Two Earth Tubs, manufactured by Green Mountain Technologies, were purchased for use in the demonstration project. We chose the Earth Tub system because it has been used for numerous projects and has a fairly good

track record. Earth Tubs are completely enclosed composting units designed to compost organic materials at the sites where they are generated. The tubs are made of insulated plastic. Each has a volume of 3.5 cubic yards. A two-tub system can handle approximately160 pounds of food scraps per day. Food scraps are loaded through a hatch in the cover. Dry materials like wood chips and shavings are added to absorb moisture and provide air space for the composting process. The compost is mixed by turning on an auger motor and rotating the Earth Tub cover by hand. A blower circulates the air and pulls air from the tub through a biofilter that absorbs odors. The biofilter is a mixture of wood chips (80%) and compost (20%) and a quart of lime in a 96 gallon garbage cart. Excess moisture exits the tub through a floor drain. After the compost process is complete, the side doors are opened and the auger pushes the compost out. Compost then sits in the open air (cures) for 30 days before use in the garden or landscaping. Two or more Earth Tubs are typically used in tandem so that a second tub can be filled while the material in the first tub is 'cooking.' Complete information on the Earth Tub system is available at www.gmt-organic.com.

Installation

A site was chosen that was close to electrical and sanitary sewer lines. A cement pad was built to hold the Earth Tubs. The pad included a drain that connected to the sewer. The amount of liquid discharged is small and Earth Tubs do not necessarily have to be directly connected to sewer lines, depending on site and regulatory specific conditions. Direct soil discharge or catch buckets have been used in rural locations. The liquid is not toxic, but is high in nutrients, hence somewhat attractive to flies.

A wooden structure was erected above the tubs to hold the electrical service for the augers. Since the augers are on top of the lids of the tubs, and the lids are rotated to turn the compost, it is ideal to have the electrical service above the tubs to avoid cord tangle problems.

The tubs were set up using the GMT Manual. GMT was contacted several times as questions arose. Prior to setting up the tubs, ORA and County staff met with and/or conferred by phone with people who had set up tubs in Sonoma County, San Francisco, Berkeley and Eugene, Oregon. The tubs were set up on two-inch blocks. The blowers were mounted on the tubs, and connected by pipe to the biofilters. Drains were connected to the sewer. Installation was completed in November 2000. The cement pad is 27x17 feet, allowing generous space for the tubs and biofilters. (See site plan, attachment 1.) In February 2001 a shed was built to house tools, spare parts, scales and record-keeping equipment for the tubs.

A sign was created to explain the composting process within the Earth Tubs. The sign explained how the food scraps are loaded, how the compost is mixed and aerated, and how the compost is removed. It was mounted above the tubs. (See photo of sign at left.)

The Earth Tubs are located right next to a Thrift Store and the public has access whenever the Grey Bears Recycling Facility is open. We took precautions to make sure children and curious adults would not tamper with the tubs by putting padlocks on the side and top loading doors of the Earth Tubs. The electrical switches were mounted in a padlocked box.

Operations

Before food scaps are added to the tub, it is necessary to put down something to keep small particles from blocking the aeration floor. The manufacturer recommends large landscape bark wood chips, but we found that mulch cloth worked just as well, and was easier to retrieve and use

repeatedly. Tubs were then filled about half-full of sawdust. Fortunately, the Grey Bears facility is right next door to a woodworking shop and the owners are more than happy to supply full bins of sawdust for free. We filled the first tub with a mixture of sawdust and wood chips, but we found the wood chips did not break down as readily as the sawdust and were not really necessary for aeration, so we have used sawdust for bulking agent in subsequent tubs.

After filling the tub halfway with sawdust we start adding food scraps, usually lettuce or vegetables. Temperatures generally reach 120 degrees within a week or two. Moisture level in the material is monitored and when it gets fairly moist, we start adding sawdust to balance the moisture. The vegetables contain more than enough moisture to complete the compost process. We added 94 gallons of water to the Holiday Dinner batch, as the paper plates and napkins required additional moisture (more information below). Temperatures stay in the 120-140 degree range. There is a 1/2-1 inch space between the auger run and the tub wall where unmixed material collects. Every week we scrape the sides of the tub with a shovel in order to mix this material with the other material.

When we have added between 3000 and 4000 pounds of food scraps, we stop adding material and let the mixture 'cook' for about two weeks. At that point, we remove the material from the tubs. If we were working to produce premium compost, we would need to let the tubs cook for at least a month, but our main interest in the operation is to divert as much tonnage of food scraps as possible. Compost quality is a secondary interest. Nonetheless, compost has been a popular product, promoted through the Grey Bears newsletter.

After emptying the tubs, the floor drains are cleaned and sediment is removed from the drainage channels. The manufacturer recommends this be done only once every six months, but since we have had problems with drainage (see Operational Issues below), we have done it after each batch. Ideally, we would like to do it less frequently and leave some compost in the tub as a 'starter.'

The Grey Bears receive food donations from many produce houses in the Salinas Valley. To keep the donations flowing, they have to take some food they don't want and can't use, along with the food they need. Although they make the surplus available to other charitable organizations and animal feeders, they often dispose of whole pallets of produce. Feedstock for the Earth Tubs was generally cartons of vegetables and salad mix. Often salad mix needed to be removed from individual bags. Occasionally we added 4x4 foot pallet bins of produce culls or bread to the tubs. All food scraps were weighed, unless they were in boxes with weight stamped on the side. Cubic measure of the food scraps was calculated, either by measuring the boxes or estimating the cubic measure of food in the pallet bins.

Because we generally had pallet-loads of vegetables, salad mix and bread to use as feedstock for the compost, separate collection of food scraps in the warehouse and the office was not started until September 2001. Warehouse garbage includes paper towels from hand washing and food discards from day-to-day operations. Food scraps from the volunteer/staff lunch (20-40 served Monday-Friday), kitchen discards as well as paper plates and plate scraping from the serving area are included. Collecting food scraps in the warehouse will present a challenge in terms of training, as 95% of the labor is volunteer, and many volunteers come only 1-2 times per week. No data is available on this collection program, due to the late start-up date.

Although the manufacturer recommends chopping or grinding material to reduce particle size, we found this step was unnecessary. Cabbage heads were the largest vegetable we composted; we would recommend cutting large firm vegetables and fruits like pumpkins or watermelon, based on size and consistency, as they could jam the auger if caught between the tub wall and the auger. We did add uncut loaves of bread, and found they could be left in their paper wrappers. We consulted with tub managers in other locations and found they also did not cut or chop vegetables

prior to composting. Once we received a pallet of cardoon hearts that were about 2 feet long and 3 inches in diameter. It took about two weeks for the woody stick-like vegetable to begin breaking down, and they were hard on the auger and it was difficult to move the auger through the material. We would recommend against composting such materials in the Earth Tubs.

Records were kept of tub high and low temperatures, weight and volume of food scraps added, volume of sawdust added, gallons of water added, turning of the tubs and time spent filling, turning and emptying tubs. The record form also included a space for comments. Records were updated each time the tubs were serviced, and downloaded into a computerized tub log weekly. A sample of the record collection form (Compost Activity Record Worksheet) is included as attachment 2. Copies of complete record database are available on request.

The Operating Instructions that come with the Earth Tub are excellent. We encouraged staff and volunteers to read the instructions and augmented them with a Supplement to Earth Tub Operating Instructions (attachment 3).

Composting of Holiday Dinner Food Scraps and Tableware

In December 2000 the tubs were used to compost 520 pounds of table scraps and BioCorp and Chinet biodegradable tableware collected at the Grey Bears annual Holiday Dinner, where 1500 turkey dinners were served to seniors and the disabled community. Volunteers from a local school and the County Public Works Department cleared the table and separated biodegradable items from recyclables and garbage. Once in the tub, the plates, cups and napkins broke down right away. Earth Tubs can handle as much as 10% meat by weight, and the table scraps provided moisture to balance the somewhat dry tableware. About 2450 pounds of vegetables were added over the next few weeks and after 90 days of composting, with temperatures in the 120-140 degree range at the peak, everything was broken down except for the utensils, which are made from highly compressed cornstarch. They did deteriorate, however, and the Grey Bears were enthusiastic about the compost despite the presence of pieces of undecomposed tableware. ORA spoke with several colleagues about this, and concluded that the utensils would need a great deal more agitation than the tub system provides to decompose more fully. Basically, if they are beat up enough the particle size gets small enough so that the utensil scraps are not detected in the finished compost. Ideally, the utensils would be collected separately and ground before adding to the Earth Tubs. Soaking in water does not hasten breakdown.

Labor

Labor for daily operations of the tubs was provided by Grey Bears volunteers and staff, County Public Works staff and the Project Manager. Since we sometimes loaded as much as 1000 pounds of food scraps into the tubs in one day, and might go for as long as a week before loading in more material, labor per week was highly variable. Also, starting a new tub and unloading a tub of compost were labor intensive. Since the savings on garbage bills is computed based on material diverted by one tub full of compost (see Economic Analysis, below), it makes sense to compute labor required to produce one tub full of compost. The following table lists the tasks involved in preparing one tub of compost. Assumptions are that 1.98 tons of food scraps are combined with 3 cubic yards of sawdust as feedstock, and composting time, start to finish is 50 days. It is assumed that food scraps do not need to be de-bagged or cut.

Table: Labor tasks and hours

Tasks to prepare one tub full of compost	Average labor hours
Fill new tub half-full of sawdust	1.5
Add food scraps and sawdust as required for optimum composting	8.00
Turn tub and perform required daily record-keeping (assume turning on 30 occasions at 7.5 minutes per turning)	3.75
Empty tub, clean and prepare for next use	2.50
TOTAL	15.75

Although the Grey Bears have a low cost labor source, provided by senior volunteers, court referrals and students performing community service, it was difficult to secure volunteers for the Earth Tub project. Many of the senior volunteers are not physically able to load large quantities of food scraps into the tubs, or to unload the tubs. Court referrals and community service volunteers were not available for the project. The Grey Bears had a commitment from the American Association for Retired People (AARP) Senior Employment Program for two employees, at 20 hours per week each, to sort food discards and provide the labor for daily operation of the in-vessel system, but the employees never materialized. They Grey Bears requested an intern from UCSC, but no students volunteered. The Grey Bears also ran articles in their newsletter asking for volunteers for the Earth Tubs. One volunteer did step forward, and he was able and willing to load and service the tubs 3-4 days per week and take an active role in tub troubleshooting and reconfiguration. The Grey Bears will continue in their efforts to find volunteers for the project.

The staff person charged with responsibility for the Earth Tubs works in the warehouse, which is across the lot from the Earth Tubs. Due to work-load and priorities, he did not take an active role in the project. If the tubs are moved into the lot behind the warehouse, it will be easier for the warehouse staff to supervise volunteers and stay involved in the project.

Finished Compost

Finished compost was removed from the tubs by opening the side hatches and running the auger. The auger pushes about half the compost out, and the remainder can be removed using buckets or shovels. We purchased a wheelbarrow with a curved front from GMT that has been useful for removing the compost. We have also used a tarp as a catcher for the compost, with two people picking up the tarp and dumping contents into the 4 by 4 foot pallet bin used for curing. Compost is allowed to slowly finish decomposing (cure) for about four weeks before it is used. Tubs generally yield about a bin and a half (48 cubic feet) of finished compost.

We had very little problem with contaminants in the compost. Since most of the compostables were received in cartons from produce houses, they did not include contaminants that are typically introduced by human error in sorting discards. The batch that included Holiday Dinner discards contained more contaminants, but, due to careful collection and visual screening, contamination level was very low.

The material in the bottom of the tubs is not reached by the auger, and it tends to be somewhat anaerobic, and not very well decomposed. We generally put it into the actively composting tub, to be re-composted.

We had the first batch of compost analyzed. The bulking agent used for this batch was half sawdust and half wood chips. Nutrient content was average, lime and ash content were low, soluble salts were average and particle size was suitable for all uses. Ammonia and nitrate nitrogen ratio indicated mature compost. However, we were advised that the carbon to nitrogen ration was high (35), and that the material would be most appropriately used as a surface mulch. Soil incorporation would be likely to tie up nitrogen. Longer composting and/or curing time would allow for further breakdown of the carbon, but the main interest for this project is food scrap diversion. Subsequent batches used sawdust for bulking agent (rather than wood chip/sawdust mix) and may have had lower carbon to nitrogen ratios. The analysis is included as attachment 4.

Compost was given away free until September 2001. The product was very popular. It was left in a pallet bin and people loaded their own bags, buckets and boxes. It took just a few days for people to remove one batch of compost. To improve the economics for the project, the Grey Bears started selling compost for $2/bucket in September 2001 through their Thrift Store. Sales have been brisk; the only problem is keeping the compost in stock. Clean buckets are often dropped off at the facility for recycling, so are readily available. Since each bucket holds 5 gallons, and each cubic foot is expected to yield 7.5 gallons, it is expected that each batch of compost will produce about 72 buckets of compost, netting $144.

Weight and Volume Reduction

Weight and volume reduction of material was impressive. Our feedstock tended to be vegetables, which are very high in moisture. A total of six tubs of material were composted between tub installation in November 2000 and end of the reporting period in August 2001. We tracked weight of food scraps for the all tubs, and volume of food scraps for the last four tubs. Complications were also tracked, as they often caused us to stop loading a tub with food scraps before it was full. The table below provides information on weight and volume of food scraps loaded into each of the six tubs, and complications.

Table: Weight and volume of food scraps by tub

Tub #	dates	Days start to harvest	Weight food scraps (pounds)	Volume food scraps, in cubic yards, if available	Complications
1	11/15 to 1/5/01	50	2,968	NA	Auger bogged down, so we stopped adding material. Auger motor was found to be defective, was replaced.
2	12/4 to 4/2	118	2969	NA	Waited for Biocorp utensils to decompose, which lengthened composting time.
1	1/23 to 4/26	93	3858	11.37	Auger mover broke, causing us to terminate tub. Tub was loaded very slowly, due to volunteer/staff time.
2	4/4 to 5/16	42	2610	8.83	Leachate coming out blower hole problem caused us to terminate tub early.
1	5/3 to 8/1	89	4061	9.75	Cardoon was so stiff we were afraid to add anything else for a while, lest it break the auger.
2	6/6 to 9/10	94	7281	19.5	Tub was filled to capacity to see if the auger could handle a heavy load. When full, the tub was so heavy it was hard to turn, and circuit breaker frequently flipped due to strain on auger motor.
	TOTAL		23,747		

By averaging all six of the tubs, we get an average of 3958 pounds (1.98 tons) per tub. By averaging the four tubs for which volume information is available, we get a figure of 5.5 cubic yards per ton (10.89 cubic yards per tub). Approximately three cubic yards of sawdust were used as bulking agent for an average tub, with a weight of 0.2 tons. Tubs generally yield about 48 cubic feet of finished compost, weighing 0.52 tons. The following table summarizes the weight and volume reduction for the material, from feedstock to finished compost.

Table: Weight and volume reduction

Item	Weight (tons)	Volume (cubic yards)
Food scraps	1.98	10.89
Sawdust	0.20	3.00
Finished compost	0.52	1.78
Percent retained	24%	13%
Percent reduction	76%	87%

Temperature and Pathogen Destruction

State of California health guidelines for in-vessel composting call for maintaining compost under aerobic conditions at a temperature of 131 degrees F. or higher for three days or longer to reduce pathogens. We found it was easy to meet these guidelines. Our tubs were located in a sunny spot, and temperatures in Santa Cruz are mild, so we found little variation in temperature summer to winter. We took temperatures in two areas inside each tub, one around the edge of the tub, and another towards the center over the aeration floor. Temperatures near the edge tended to be higher than those over the aeration floor. We hit temperatures over 131 degrees F at the edge of the tub for at least three days for each tub full of material. The GMT Operations Manual advises to turn the blower off if temperatures are inadequate, but we never had to do this. Temperatures can also be regulated by adjusting the ball valve in the aeration lines.

Odor Control

Odor was an issue for the project, as the tubs were located next to the open-air section of the Grey Bears Thrift Store. The Thrift Store volunteers often commented on the odors. The tubs leaked (see below, Operational Issues) and the leachate created a visual as well as an olfactory problem. The cement pad was not level, and moisture pooled in a few areas, including under the tubs. We would emphasize that when constructing a pad or selecting a site, particular attention should be given to this detail to minimize potential for such problems.

The tub center posts were designed to allow air from the area above the composting material to be sucked down and blown out through the biofilter. The posts were the right length when the tubs were empty, but the tubs flexed when they were heavy with compostables and the posts were too short. When this happened, they dropped out of the cups in the lid that held them upright, and were removed so they wouldn't be hit by the augers. This allowed odors from the compost to escape without benefit of biofiltration. When the tubs were emptied, we pushed the lids up from inside to enlarge the space between the tub floor and lid, and were able to insert longer center posts.

The biofilters must be moist in order to operate properly. In order for the biofilters to stay moist, the tubs must be full of moist, hot composting material and the blowers must be running. Biofilters

are likely to dry out during the period of time when compost is being removed and the tubs are being cleaned out and prepared for another batch. If the biofilters dry out, they are difficult to re-wet. They must either be stirred while being moistened, or the material must be taken out of the biofilter cart and re-wetted. We were not as vigilant as we should have been about keeping the biofilters moist.

Odors emanating from the Earth Tubs peak when the material is turned with the auger, especially if the hatch in the cover is left open. Earth Tub volunteers tried to do the turning after the Thrift Store volunteers went home.

Odors were minimal during the winter, but definitely presented more of a problem in warm weather. The warm weather also brought flies, who were very interested in buzzing around any leachate or even dried leachate stains on the cement pad.

Operational Issues

In-vessel composting technology has been around for several years but it is still in its infancy. The Earth Tub system is based on sound composting principles and it has performed fairly well in this project. We have been extremely satisfied with the ability of the Earth Tubs to produce an acceptable compost product. However, we have had to overcome some technical glitches, mainly concerning mechanical and structural components.

Molded plastic tubs of this size are bound to have irregularities. We struggled to mount one of the blowers due to the irregular shape of the tub at the mounting point. We needed to add a spacer bar to keep the auger from hitting the tub wall in an area where it pouched in. We had to file down a plastic ridge that covered part of the tub drain.

We had a few problems with the auger motor, which was manufactured by a third party. It was supposed to be weather-proof, but it failed due to water entering the blower above the motor. (It was replaced by GMT.) The auger seemed a bit under-powered, as it sometimes stalled when the tub was full of composting material, even when that material was quite well decomposed. Ours was a single-phase (110 volt) installation. According to the manufacturer, a 3-phase, 220 volt installation is more efficient, runs cooler, and is higher-powered. In retrospect, it would have been better to install 3-phase power.

The most perplexing problem concerned the aeration floor, the blower and the drainage system. The aeration floor is a perforated metal rectangle that fits over an area of the plastic bottom of the tub. Below the aeration floor there is a molded aeration channel and a molded drainage channel. The drain at the end of the drainage channel is just about a quarter inch below the mounting hole for the blower, at the end of the aeration channel. (The blower mounts directly on the side of the tub.) Since the blower is actively pulling air out of the tub, it is inevitable that some of the liquid will be pulled out through the mounting hole for the blower. At that point, it can leak out of the tub from behind the blower or it can be sucked into the blower, sometimes causing the blower to shut down.

We tried different methods to solve this problem, from filing down a plastic ridge at the entrance to the tub drain channel to mounting the blower on the side of the biofilter. Generally, system modifications can only be done when the tub is empty, and the result is not known until the tub is again in service. After we purchased our Earth Tubs, GMT modified the design and now ships biofilters with the blower mounted on the inside near the rim. GMT provided us with such a biofilter in August 2001. So far, we have not had any leachate problems and the unit is performing well.

Other problems were mainly mechanical and were fairly simple, if bothersome, to correct. Problems with the tubs were tracked in a log. For complete information, see attachment 5, Detail of Operational Issues.

Economic Analysis

The savings on garbage bills can be compared to the cost of equipment, installation, and operation costs. The following tables detail the cost of installation and operation for the Grey Bears, and the annual projected Grey Bears costs and saving.

Table: Grey Bears Cost of Installation and Operation (one year)

Requirement	Cost	Description
Two Earth Tubs	$14,495	Equipment and shipping
Cement pad	$1132	27 by 17 foot cement pad
Electrical service	$1794	Provision of electrical service for augers and blowers
Plumbing to sewer drain	$346	Initial plumbing installation cost
Padlocks	$35	7 locks (3/tub, 1 for switch box)
TOTAL EQUIPMENT AND INSTALLATION	**$17,802.00**	
Labor	$780	One hour per week staff time ($15/hr), balance free volunteer labor. Annual cost.
Electricity	$100	Manufacturer's estimate, annual cost
TOTAL ANNUAL OPERATION & LABOR COSTS	**$880**	
Bulking agent (sawdust)	free	Provided by cabinet shop
Siting space (min. req.)	NA	10 feet by 22 feet
Curing space (min. req.)	NA	4 feet by 4 feet
Bulking agent space (min. req.)	NA	4 feet by 4 feet

The Grey Bears pay $125 per pull and $36 per ton for service of their 20 cubic yard dumpster. During the 8.5 months that the tubs were in service, 11.87 tons of food scraps were composted. Average volume of the food scraps was 5.55 cubic yards per ton. On the average, each tub of compost that was produced diverted 1.98 tons of food scraps, which would have occupied 10.89 cubic yards in their dumpster. For each tubful of compost, they save $71.28 on weight charges and $68.06 on pull charges (based on volume). If they compost at the same rate for the entire year, they will divert 16.76 tons and will save $1179 in garbage service.

There is typically a 'shakedown period' in the use of any new equipment, and the Earth Tubs were no exception. As described above under Operational Issues, some equipment problems were encountered, and diversion figures above are based on operations in the shakedown period. Diversion rate should be higher after the shakedown period through improved operations. It is reasonable to expect that each tubful of compost can be completed in 50 days. At that rate, and assuming an average tub handles 1.98 tons (10.89 cubic yards) of food scraps, there will be an annual savings on garbage bills of $2034 ($139.34 per tub, 14.6 tubs per year). This will be offset

by annual labor and operation costs of $880. Revenue from compost sales is projected at $2102 (72 buckets per tub, 14.6 tubs per year). Each tub full of compost also diverts 0.2 tons of sawdust. Over the course of a year, 2.92 tons of sawdust will be diverted from disposal.

Since this is a new technology, we do not know how long the tubs will remain operable, or how much maintenance costs will be. If we amortize the equipment and installation costs over a ten-year life span, this adds $1780 per year to annual operating costs. Although this was a grant-funded project, I have added this cost to the Grey Bears analysis. The table below shows projected annual diversion, cost and savings for the installation.

Table: Projected Grey Bears annual diversion, costs and savings

Diversion tonnage (food scraps)	28.91 tons
Diversion cubic yards (food scraps)	158.99 cubic yards
Diversion tonnage (sawdust)	2.92 tons
Diversion cubic yards (sawdust)	43.80 cubic yards
Savings on garbage hauling and disposal	$2034
Revenue from compost sales	$2102
Labor and operations costs	-$880
Equipment and installation cost, 10 year amortization	-$1780
TOTAL ANNUAL SAVINGS AND REVENUE	$1476.00

It would take the Grey Bears about 5.5 years to recoup the costs of the system and its installation.

The decision to install and use Earth Tubs must be made on a case-by-case basis. From an environmental standpoint, they clearly make sense for any generator with a large percentage of food scrap discards. From an economic standpoint, cost of installation and operation must be balanced against savings on garbage collection and value of the compost, whether sold or used on site. Cost of garbage collection and disposal should include lock and push out charges, if applicable. Businesses and organizations with a high level of interest in educational and environmental benefits, with an avenue to sell or use the compost, and with a source of inexpensive labor will reap the greatest benefit.

Educational and Environmental Benefits

The environmental benefits of the project are indisputable. Over 11 tons of food scraps were diverted from the County landfill, extending the landfill's life. The environmental impacts (air pollution, transportation congestion, depletion of fossil fuels) of hauling 11 tons of material to the County landfill were avoided. Potential environmental impacts from landfill use (generation of methane gas, pollution of ground water) were avoided. The resulting compost was used to improve local soils.

The project was a vehicle for educating commercial generators about food scrap diversion. Outreach efforts succeeded in attracting the attention of managers of food scrap generating businesses. We were able to promote the idea of food scrap diversion and distribute information on on-site composting as well as other diversion methods. The Grey Bears outreach efforts educated many community members about commercial food scrap diversion. To the extent that the public understands that food scrap diversion is important and recognizes that businesses are working on solutions, they are more willing to compost their own food scraps at home.

Lessons Learned

On-site diversion systems should be located at least 40 feet from places where people will be eating or working. If possible, the tubs should be placed so that the people responsible for operations are the first impacted if odors do occur.

Tub loading needs to be monitored so that too great a strain is not placed on the auger motor. Providing the auger with 3-phase power would improve auger motor performance. Auger load is highly dependent on the type of material being composted. We found it helpful to rotate the tub with the auger near the center of the tub first, then gradually move the auger out to mix the material further from the center. This maximizes leverage, and lessens the strain on the auger motor.

Grind up BioCorp utensils before composting. This should assure the particles will be small enough to escape detection in the finished compost.

Future of Mechanized On-Site Diversion in Santa Cruz County

The Earth Tubs at Grey Bears were the first venture in the County using a mechanized hot composting system. Although we had to overcome some challenges in operations, we will continue to recommend Earth Tubs and other mechanized on-site diversion systems for select food scrap generating businesses. Through outreach efforts centered on the Grey Bears project, we established contact with several business owners who are currently considering on-site diversion systems. The Grey Bears plan to continue using the Earth Tubs and we have been approached by a member of the Board of Directors who wants to expand on-site diversion infrastructure to handle all unwanted food scraps (estimated at one ton per week) generated at the facility. We are working with various vendors to determine which systems will be the best fit for the waste streams at the individual businesses. The County offers Waste Reduction Grants to businesses to help defray the cost of food scrap diversion projects, as well as other recycling projects.

We also spoke with managers of many other food businesses who said they are not considering on-site diversion at this time. For restaurants and grocery stores, the primary objection to on-site diversion is the space it takes and the labor issues. Some businesses actually have a small amount of food scraps as most food is purchased already trimmed and cut. For some businesses, such as Dominican hospital, the plate scrapings are mixed with lots of non-biodegradable individual serving packaging and it would be difficult to separate compostables.

Project Outreach

Outreach for the project was extensive. The goal was to inform Santa Cruz County food waste generating businesses of the availability of on-site composting systems and about other options for diversion of food scraps.

Events and Presentations Highlighting the Tub

We held a Kick Off Event, “Explore the Options,” January 31, 2001. We sent out over 1000 invitations to the event, along with the project brochure, to food

service businesses, local government, and other interested parties. Over 50 people attended, including representatives from Environmental Health, local restaurants, hospitals and conference centers, public schools, retirement homes and local goverment. Presentations were made on the options for diverting food scraps and the Earth Tubs were demonstrated.

The tubs were also highlighted at the following events:

Holiday Dinner: Nearly 1500 attendees at the Grey Bears Annual Holiday Dinner were informed that they were using biodegradable plates, cups and utensils that would be composted in the Earth Tubs. This helped to spread awareness about the program.

Awards Ceremony: The Earth Tub was highlighted at the California Grey Bears Awards Ceremony/Open House held May 11, 2001. The event was attended by local government, elected officials and members of the public. The tubs were demonstrated by ORA.

Presentation at BioCycle 2001: Karin Grobe, ORA, presented "Combining Food Distribution with Composting" in the Collecting and Processing Food Residuals session. The presentation highlighted Grey Bears food redistribution efforts and use of the Earth Tubs. The presentation included slides and handouts were available for attendees.

Presentation to Master Composters: Master Composters in Santa Clara County and Master Composters and Vermicomposters in Santa Cruz County were given presentations on the Earth Tub project. A slide presentation was used for the Santa Clara group, and the Santa Cruz County presentation was a live demonstration of the Earth Tubs at the Grey Bears.

Grey Bears Recycling Tours: Grey Bears give about 4 tours per month to school groups, senior groups and new volunteers. The Earth Tubs are always included as part of the tour and highlighted as appropriate.

Presentation at Food Diversion Workshop for Santa Clara, San Mateo and San Francisco Counties, October, 2001: Karin Grobe, ORA, will present "California Grey Bears: A Case Study" for the in-vessel composting component of the workshop.

Project Publications

Project Brochures: The first brochure, which was sent to over 1000 food-related businesses, included information on environmental and economic benefits of food scrap diversion. It also included a contact (ORA) to offer businesses assistance in matching with charitable organizations seeking donations or animal feeders looking for food scraps. Technical assistance for businesses to set up diversion systems was also offered. (See attachment 6.)

The second brochure, which was sent to over 1000 food-related businesses, included information on environmental and economic benefits of food scrap diversion and on the results of the Earth Tub project at Grey Bears. (See attachment 7.) Technical assistance for businesses to set up diversion systems, or to match with charitable organizations or animal feeders was also offered. It was sent with the fact sheet, "Food Donation Opportunities in Santa Cruz County."

Fact Sheets: Two fact sheets were developed. "Food Donation Opportunities in Santa Cruz County" lists agencies that accept food donations for feeding the hungry. "California and Oregon Sites Using In-Vessel Composting Systems" lists sites using Earth Tubs and gives quantity of food waste diverted and savings on waste disposal for each installation (Attachments 8 and 9).

Other Outreach Components

Website: The project website includes information on the composting system, the economics of on-site diversion, general information on food waste, the benefits of diverting food waste, links to the California Integrated Waste Management Board's website, information on food donation opportunities in Santa Cruz County, and information on worm bins for camps and schools. The website address was included in the brochures.

Signage: A large sign was made and mounted above the tubs to inform Grey Bears Facility visitors and volunteers about the project. The sign includes an overview of the project and information on the composting system, tub operation, project sponsors and numbers to call for more information. Attachment 10 is a draft of the sign that was used to guide the graphic artist.

Compost Give-Aways and Sales: Until September 2001 compost from the tubs was given away by the Grey Bears to volunteers and members who picked it up in bags and boxes. The availability of the compost was highlighted in "BearPrints," the Grey Bears newsletter. The compost was enthusiastically received and it helped to build awareness and appreciation for the program. Starting in September 2001 the compost was sold through the Grey Bears' Thrift Store.

Slide Sets: Custom slide sets are available on request. Interested parties should contact Karin Grobe, ORA, 831-427-3452, kgrobe@pacbell.net.

Local Publicity: Local publications, include the Santa Cruz Sentinel and the Sierra Club Ventana Chapter printed articles on the food scrap diversion project. The Grey Bears newsletter printed many articles about the Earth Tub project.

National Publicity: An article on the project will be submitted to *BioCycle* for publication in Winter 2001-02.

List of Attachments:

1. Site Plan for Earth Tub installation
2. Compost Activity Record Worksheet
3. Supplement to Earth Tub Operating Instructions
4. Compost Analysis
5. Detail of Operational Issues
6. Brochure #1
7. Brochure #2
8. Food Donation Opportunities in Santa Cruz County
9. California and Oregon Sites Using In-Vessel Composting Systems
10. Draft Sign